NEW ZEALAND
SYNCHROTRON GROUP

ANNUAL REPORT 2020

Contents

CHAIRMAN'S REPORT

The year under review was the fourteenth year during which the New Zealand Synchrotron Group Ltd (NZSG) has provided support for New Zealand researchers using the Australian Synchrotron.

The past year was the third under the new funding and access arrangement negotiated in 2017 which substantially increased the amount of beamtime that New Zealand researchers can get. However, access was interrupted late in the year by the COVID-19 pandemic when the Australian Synchrotron had to cease operations for a period and by the ban on international travel. By the end of the financial year there was a backlog of experiments that had not been able to be completed. As of writing this report, operations have just resumed, but because of the travel ban, only a proportion of the affected work can be undertaken.

It is anticipated that the impact of the pandemic will be significant, and it may take up to two years until a normal cycle of application, award and take-up of beamtime can resume. The company is working closely with ANSTO to ensure that priority is given to the rescheduling and support of New Zealand work at the Australian Synchrotron, where that is possible, and to having flexible arrangements for work that has to be deferred for a lengthy period.

Recognising the financial pressures that the New Zealand research institutions are experiencing due to COVID-19 and the reduced quantity of beamtime that will be used over the next year or so, the company has entered discussions with ANSTO about modifying the payment schedule for the next period, but still ensuring that New Zealand continues to make the required contribution to the new beamline construction programme.

That programme, to expand the Synchrotron by adding eight new beamlines is now well under way. Design and construction of all eight beamlines has commenced. New Zealand has already contributed A$8.4 million of the A$12 million to the beamline fund. This has secured a significant proportion of time for New Zealand researchers on the new beamlines and favourable treatment in the way in which it will be allocated. The contributed funds are provided jointly by the New Zealand government and eight company shareholders. The commissioning of the first three of the new beamlines is likely to be delayed by up to 9 months because of the COVID-19 pandemic, but the other five beamlines are unaffected.

The company has secured $300,000 funding from MBIE which will be added to $100,000 provided by NZSG for a Capability Build Fund that will provide funding to seed new projects and for travel to enable researchers to be ready for the new beamlines. This is important as new measurement techniques and will become available with the commissioning of each of the new beamlines and for some

beamlines it is likely that researcher who are unfamiliar with synchrotron science techniques will be potential new users. The Fund will be launched later this year.

The company had budgeted for a small surplus of $3,088 for the year but achieved a final result of a surplus of $100,508. This unexpected surplus mainly arose because money set aside in the budget to purchase additional beamtime to support the merit beamtime awards was not required. The money not spent will effectively provide the company's contribution to the Capability Build Programme. Shareholder equity rose from $497,240 to $602,928.

As indicated in previous reports, changes in the exchange rate are one of the largest challenges the company faces. During the year, the company took three additional forward contracts that cover the annual payments to ANSTO until 2024. This not only provides certainty around the cost of foreign currency for most of the remainder of the contract period with ANSTO, but will reduce the annual impact of foreign currency fluctuations on the company's operations.

The board has been very well supported by the Royal Society of New Zealand who provide secretariat services to NZSG. In particular, I would like to acknowledge the contribution make by Dr Don Smith in assisting the board, administering the New Zealand Synchrotron Support Programme and looking after our interests in Australia and on the Asia Oceania Forum for Synchrotron Radiation Research. I would also like to acknowledge the contribution from the Chair of the Access Committee, Professor Geoff Jameson and its members Professor Vic Arcus, Dr Vladimir Golovko and Associate Professor Geoff Waterhouse who have evaluated all requests for access.

Finally, I would like to thank my fellow directors, Professors Catherine Day, Geoff Jameson and Jim Metson and especially Professor Mike McWilliams who is retiring from the Board at the AGM in November 2020.

GA Carnaby
Chair

BUSINESS REVIEW

COVID-19 Impact

As mentioned in the Chairman's Report, the COVID pandemic has had a substantial impact on NZSG's ability to deliver the expected amount of beamtime to New Zealand researchers. The effects came towards the end of the financial year and are likely to impact over the next two years, at least. The Australian Synchrotron closed completely in late March for an extended period. It reopened briefly in June only to be shut down again when the second lockdown occurred in Melbourne. As of writing this report, the facility has reopened, but only for local (Victorian) researchers or for work on some of the beamlines where it is possible to ship samples to Melbourne and run the experiments remotely. By the end of June 80 shifts, representing 30% of the 267 shifts per year entitlement for the 2019/20 year, had not been delivered.

While international travel restrictions remain in place, the experiments that require on-site access to the beamlines for New Zealand researchers will not be able to be undertaken. This could be as much as 30-40% of the work normally put forward by New Zealand researchers. In addition, there has been a slow-down in applications for beamtime, possibly due to the uncertainty of international travel, but also because of the drop in international student numbers.

In recognition of the likely altered pattern of use and the time it will take for "normal" operations to resume at the Synchrotron, discussions have commenced with ANSTO to ensure that priority is given to rescheduling the postponed New Zealand beamtime, the necessary support is given to maximise the amount of beamtime that can be completed by "remote" operation and to rebalance the access levels and funding requirements over the next few years.

Investment in the Australian Synchrotron and Access Rights

The New Zealand research community has been a significant stakeholder in the Australian Synchrotron since its inception in 2007. At that time, the Synchrotron was predominantly owned by the Victorian government. Through NZSG, New Zealand held shares in both the ownership and operating companies set up at the time. In 2016, ownership of the Australian Synchrotron was transferred to the Australian government and was vested in the Australian Nuclear Sciences and Technology Organisation (ANSTO).

Although the Synchrotron is now operated by an entity independent of the original foundation investors, its operations are overseen by a Stakeholders Committee that monitors the Synchrotron's operations, budget and development and provides advice to ANSTO. New Zealand, as the largest single contributor towards the cost of the new beamlines being added to the facility and a significant user group, is a key stakeholder. The NZSG board appointed Dr Don Smith as the company's representative on the Stakeholders Committee. Dr Smith is also the contact person for day-to-day matters associated with access arrangements and user liaison with ANSTO.

New funding and access arrangements were negotiated in 2017 which gave New Zealand an extended period of guaranteed access until June 2026, increased the number of merit shifts on the existing beamlines from 201 to 267 per year, and established access rights to both merit and preferred access beamtime on the new beamlines that will be constructed over the next 5 years. New Zealand makes an annual payment of A$1.5 million towards the cost of access and is contributing A$12 million towards the cost of the new beamlines. Access and capital costs are equally shared by the New Zealand research sector and the government. The government's A$6 million contribution was paid to ANSTO during the 2017/18 financial year. The sector's share is being paid in 5 instalments, the second of which was made in 2019/20.

By virtue of their participation in the joint funding arrangement with the government, researchers and students from the Universities of Auckland, Canterbury, Otago and Waikato, Auckland University of Technology, Massey University, Victoria University of Wellington and AgResearch Ltd are eligible to apply for merit beamtime on the Australian Synchrotron.

Decisions on Access and Funding Support

The funding and access agreement with ANSTO allows the company to decide how our entitlement to merit beamtime is allocated, giving best advantage to New Zealand. This includes being able to decide the distribution of beamtime between beamlines, and on the ranking of the New Zealand proposals to each beamline. New Zealand researchers from the institutions that are providing funding are eligible to apply to the Australian Synchrotron for beamtime. Their applications are first assessed on a merit basis by the Synchrotron's beamline panels and the final selections are made by an Access Committee that was established by the board to make the decisions on applications for beamline access. The members of the Committee for the past year were:

Professor Geoff Jameson, Massey University (Chair)
Professor Vic Arcus, University of Waikato
Dr Vladimir Golovko, University of Canterbury
Associate Professor Geoff Waterhouse, University of Auckland

The Committee met by teleconference throughout the year to make their selections. The table at the end of this section of the Annual Report lists the New Zealand researchers who have gained beamline access to the Australian Synchrotron from July 2019 onwards, and where applicable, summarises the travel funding support provided to them.

Use of the Australian Synchrotron by New Zealand Researchers

Approximately 80% of the available beamline time on the ten beamlines is assigned to a "merit access" pool and competitive applications are sought from researchers worldwide, including from New Zealand. Every four months, the Australian Synchrotron makes calls for proposals. Applications are made directly to the Australian Synchrotron, but as explained above, NZSG oversees the ultimate selection of which New Zealand applicants receive beamtime. Since late 2008, in recognition of the contribution New Zealand makes to operating costs, the Australian Synchrotron began contributing towards the travel costs for New Zealand researchers who obtained

beamtime at the Australian Synchrotron on an equal basis with Australian researchers. These funds are administered through NZSG.

Under the access regime agreed with ANSTO in 2017, New Zealand researchers have been entitled to receive 267 shifts of merit beamtime which is approximately 6.6% of the available beamtime. This is considerably more than was received under the former funding (but less than occurred in the early years when there was no upper limit to the level of New Zealand access to beamtime). Figure 1 shows this change in graphical format. New Zealand now receives approximately 267 shifts of beamtime each year. It should be noted that real access is approximately 30% greater than shown in the graph, because a significant number of New Zealand researchers are co-applicants with Australian colleagues who have been awarded merit beamtime. Figure 1 also includes shifts purchased by the company in 2015/16 for AUT, in 2016/17 for a multi-institutional group, and in 2017/18 for AgResearch to supplement the merit shifts.

Note that the figures for the 2019/20 year shown in these graphs are the number of shifts that were requested and awarded for the 2019/3, 2020/1 and 2020/2 applications cycles. For the most recent year, the number of shifts actually used was less because of the COVID-19 pandemic as described above.

Figure 1: Historical record of beamtime awarded to New Zealand applications

The strong interest from New Zealand researchers in using the Australian Synchrotron has continued. Some of the beamlines have had considerable upgrades made to their detectors and sample handling systems, which has reduced the time required for measurement, but despite those improvements and the higher number of shifts that have been available over the past two years, applications still outstrip the amount of beamtime available to New Zealand. Only 61% of the beamtime requested was able to be awarded.

Table 1: Success Rate for NZ Beamtime Applications – 2019/20*

Beamline	No. Shifts Requested	No. Shifts Awarded		No. Appl'ns. Received	No. Awarded Beamtime	
IMBL	30	6	20%	3	1	33%
IRM	63	39	62%	5	4	80%
PD	36	18	50%	6	3	50%
SAXS	55	35	64%	12	9	75%
SXR	51	30	59%	3	2	67%
THz	24	24	100%	3	3	100%
XAS	54	33	61%	8	4	50%
XFM	12	6	50%	2	1	50%
Subtotal	**325**	**191**	**59%**	**42**	**27**	**64%**
MX (CAPs)	118	81	69%	8	8	100%
Overall	**443**	**272**	**61%**	**50**	**35**	**70%**

* A description of the beamlines and the abbreviations used in given on pages 19-20

The following graphs demonstrate the variability in demand for beamtime over the past four years by beamline. The greatest demand has been for the crystallography (MX) beamlines with heavy demand most years for the small/wide angle x-ray scattering (SAXS), the infra-red (IRM) and the soft x-ray spectroscopy (SXR) beamlines. In the past year, there was increased interest in the x-ray adsorption spectroscopy (XAS) beamline, but less in the X-ray fluorescence microscopy beamline (XFM). The flexibility provided under the funding and access agreement with ANSTO to having a pool of beamtime from which to make awards to New Zealand researchers is particularly helpful. One of the new beamlines being constructed is a biological small angle scattering (BIOSAXS) beamline. The company pushed for the early construction of this beamline as it will reduce pressure on the MX and SAXS beamlines.

Figure 2: Beamtime demand for the past four years

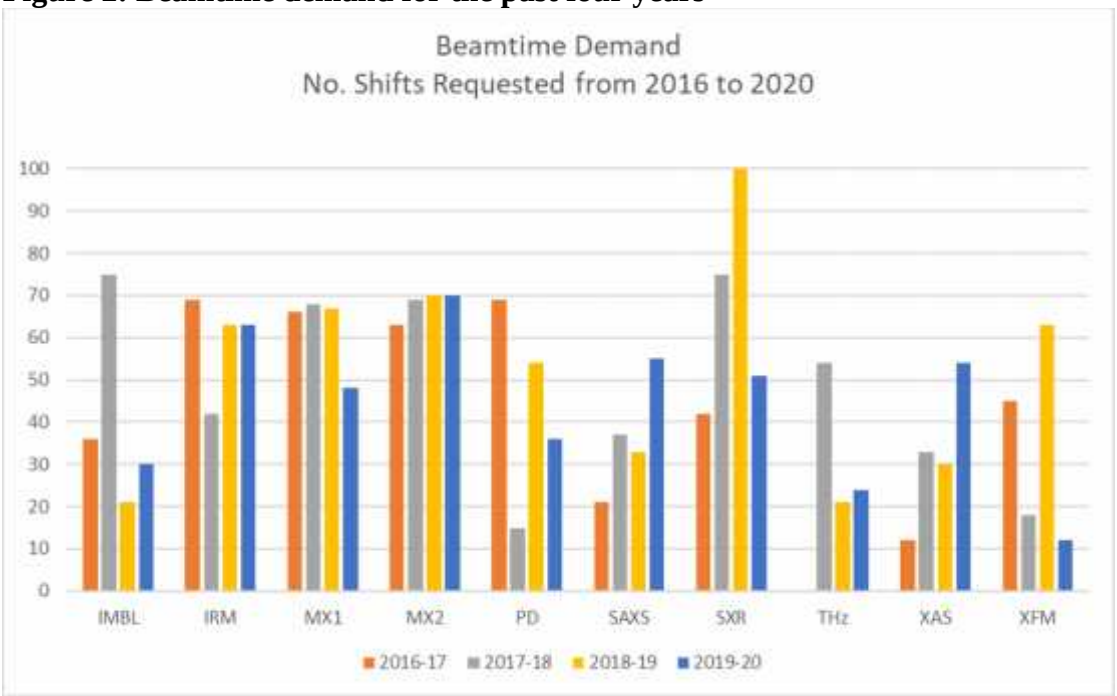
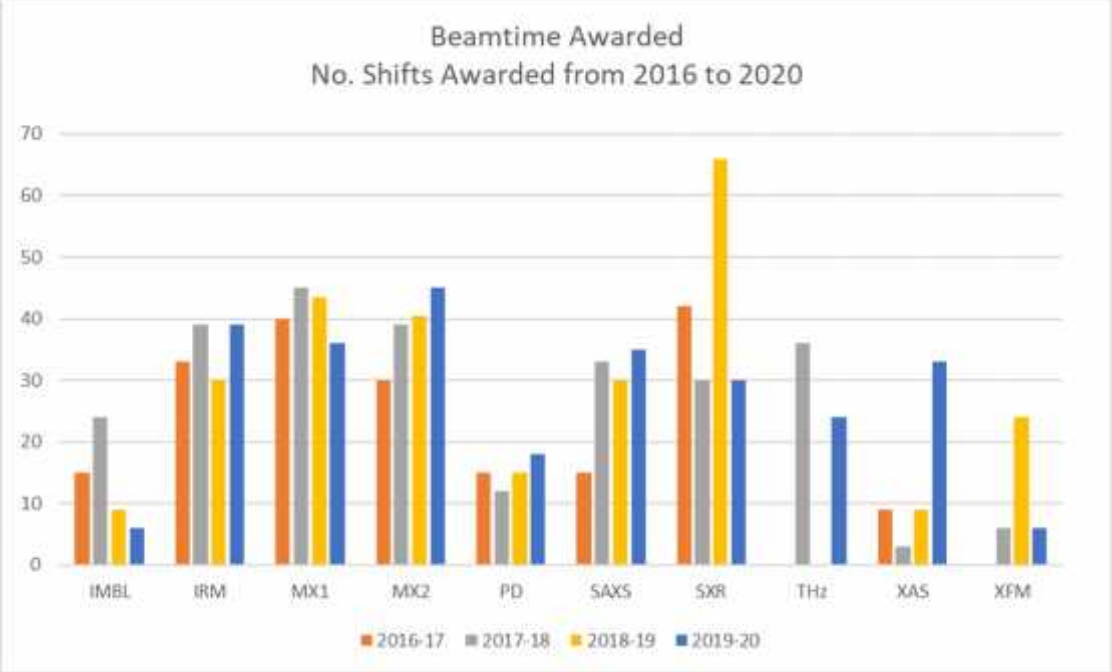


Figure 3: Beamtime awards for the past four years



Science Achievements

New Zealand researchers are strong contributors to the scientific output of the Australian Synchrotron. In the past year 40 refereed papers were produced, 5 of which were in high-impact journals.

A full list of the researchers who received merit beamtime over the past year is presented on pages 11-18. These projects cover a very broad range of science topics, and many have involved training of young researchers. Four projects are described on pages 9 and 10 illustrating the wide applicability of synchrotron science to New Zealand's research needs and the benefit of having access to the Synchrotron.

Capability Build Funding and Other Support for Synchrotron Scientists

In early 2022 the first of the new beamlines at the Australian Synchrotron will be commissioned and become available for user access. New Zealand has preferred access rights to all 8 new beamlines and it will be important to take up the full entitlement. Recognising that some of the new beamlines offer new techniques and that there will opportunities for researchers who are not currently familiar with the Synchrotron, NZSG has created a Capability Build Fund to provide seed funding for projects that will generate samples for researchers to use on the new beamlines and also provide travel funding, either for travel during the commissioning period or for researchers to use similar beamlines at other synchrotrons. The purpose of the Fund is to introduce and upskill New Zealand researchers in the techniques which will become available on the new beamlines and extend the range and quality of science New Zealand is able to undertake. NZSG has secured $300,000 funding from MBIE through an extension to the existing SIFF contract and will contribute $100,000 from reserve funds. Originally, the Capability Build Fund was to have been launched in

July 2020, but this has been delayed a few months because of the delay in the expected commissioning dates of the first three of the new beamlines due to COVID-19.

Apart from overseeing New Zealand researcher access to the Synchrotron, NZSG provides additional support by administering the travel funding available from the Australian Synchrotron, to which all groups awarded merit access are entitled.

Support was provided for students or emerging researchers to further develop their knowledge of synchrotron science techniques through attendance at the annual User Meeting held at the Australian Synchrotron and at the annual Synchrotron Radiation School run by the Asia Oceania Forum for Synchrotron Radiation Research (AOFSRR), of which NZSG is a member. The most recent User Meeting was held in Sydney in December 2019 and the AOFSSR School was held at the National Synchrotron Radiation Research Center in Tawian, also in November 2019.

The table below provides details of the students who were provided with travel funding to attend the AOF Synchrotron Radiation School in November 2019.

Name	**Institution**	**Details**	**Comment**
Matthew Sullivan	University of Auckland	PhD student	Jointly funded by AOFSRR and NZSG
Marina Richena	AgResearch	Early Career Researcher	Jointly funded by AOFSRR and NZSG
Gerd Mittelstaedt	Victoria University of Wellington	Early Career Researcher	Funded by NZSG
Velram Mohan	University of Auckland	Postdoc	Funded by NZSG
Simon Vale	Landcare	Early Career Researcher	Self-funded

D K W Smith
Executive Officer
Secretariat

Examples of Recent New Zealand Use of the Australian Synchrotron

With the completion of the Cassini-Huygens spacecraft mission to Saturn's largest moon Titan, a wealth of new information has come to light on the role of cyanides in Titan's dense and extended atmosphere. Formed in the upper atmosphere and then condensed as ices at cold, lower altitudes these cyanide (nitrile) species are thought to act as important precursors in forming molecules of biological importance. However, the crystalline phases of certain abundant Titan cyanides have not been explored.

The workgroup of Dr Courtney Ennis at the University of Otago with collaborators at the Powder Diffraction (PD) beamline at the Australian Synchrotron have resolved the crystal structure of the elusive C3 cyanide propionitrile. At 100K corresponding to Titan atmosphere, evidence for multiple polymorphs were revealed from the diffraction data that could point toward the existence of various aerosol morphologies once the molecule condenses in the Moon's lower stratosphere. This discovery has implications toward the formation of organic precursors both in the atmosphere and on the surface of Titan, where interaction of vacuum UV and energetic particle radiation can convert cyanides into amino acids and nucleobase compounds in the solid-state. Corroboration of the PD structures with vibrational data obtained at the Far-Infrared and Terahertz (THz) beamline confirm the geometry of the propionitrile ice structure is conducive to this chemical processing.

The Massey University (Palmerston North) group of Professor Geoff Jameson, Associate Professor Vyacheslav Filichev, Dr Elena Harjes and recently finished PhD student Dr Fareeda Barzak, as part of the Victoria University Wellington, Waikato University and Massey University SAXS/WAXS consortium, have been developing increasingly potent inhibitors of the DNA-mutator enzymes APOBEC3, for which intellectual property protection is now being pursued. In normal cells APOBEC3 enzymes destroy pathogenic DNA, but in many types of cancer cells they mutate host DNA, allowing cancer cells to evolve resistance to chemo- and immunotherapies. The potent nanomolar inhibitors developed, as potential conjuvant drugs, would stop this evolution of resistance and extend efficacy of current treatments. SAXS measurements undertaken at the Australian Synchrotron have been key to understanding the way DNA and inhibitors bearing modified DNA interact with APOBEC3 enzymes.

Infectious diseases are big causes of mortality and suffering, with a huge social and economic cost across the globe. With the growing development of antibiotic resistance, the tools to tackle infectious diseases caused by microbial pathogen are dwindling and new insights into microbial pathogenesis and the discovery of new drug targets is needed. This is complicated further by the ability of a range of bacteria to develop persistent phenotypes that help then survive in the human host for long periods of time forming hard to eradicate infection. Bacteria, including pathogenic bacteria rely on electron transport to power their cells. Mycobacterium tuberculosis, the causative agents of tuberculosis, the biggest infectious disease killer in 2019,

relies on electron transport for energy even in its persistent state making the study of bacterial electron transport ideal for developing new insights and therapies to tackle tuberculosis. Bacterial electron transport relies on small molecule quinone electron carriers such as menaquinone (vitamin K2). The pathways that make menaquinone are specific to bacteria and plants and not present in humans and hence understanding the enzymes in this pathway have potential to lead to the development of new anti-microbial agents.

A team lead by Dr's Jodie Johnston at the University of Canterbury and collaborating with Dr Ghader Bashiri and Dr Esther Bulloch at the University of Auckland have been using the Macro-crystallography (MX) and Small and Wide-Angle Spectroscopy (SAXS) beamlines to gain a molecular level understanding of how the menaquinone biosynthesis pathway works and the role it plays in disease pathogenesis. The work spans a range of human pathogens, including M.tuberculosis and Staphylococcus aureus (S.au), a causative agent of a range of community and hospital acquired skin, blood and medical device infections with a range of very problematic resistant forms including MRSA. The latest finding, reported this year in an editor's choice article in JBC, was that in the tuberculosis causing pathogen this pathway is under feedback regulation with one of the end products in the pathway inhibiting one of the key starting enzymes in the pathway by binding to an allosteric site. This was the first report of this form of regulation in the pathway and the team are currently extending this study to see how specific this regulation site is and if it would make a good target for selective anti-microbial drugs.

In 2016 Dr Mallett and colleagues from Fribourg University in Switzerland made a startling discovery that a superconducting material sandwiched between a specific magnetic material completely changes the behaviour of the superconductor. This unique 'superconductor sandwich' meta-material gives us a novel way to figure out how these superconductors work as well as a new way to control their properties. Also, the superconductor sandwich is unique in that its performance actually improves in a magnetic field, and this may have important implications for the burgeoning superconductor industry in New Zealand. Dr Mallett, now at The University of Auckland, has continued to work on these superconductor sandwiches, studying their electronic properties in order to understand how the magnetic material interacts with the superconductor at the interface.

One project involves understanding a new superconducting state in cuprate-manganite multilayer thin films. Dr Mallett's team developed and implemented a novel measurement capability on the Soft X-ray Resonance (SXR) beamline at the Australian Synchrotron (in-situ cryogenic biasing experiments) and observed a positive effect. These experiments are important for maintaining and building the group's international collaborations and reputation, particularly with the novel result of the biasing experiment. The understanding gained of the new superconducting state will allow the group to now develop proof-of-principle electronic devices from these thin-film multilayers.

New Zealand Research Groups Awarded Beamtime (July 2019 – June 2020)

The following New Zealand research groups were awarded merit time at the Australian Synchrotron between July 2019 and June 2020.

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Assoc Prof Chris Squire Dr Nikki Moreland Dr Shaun Lott Dr Jodie Johnston Assoc Prof Alok Mitra Dr Richard Kingston Prof Juliet Gerrard Dr Ivanhoe Leung Dr Ghader Bashiri Dr Jason Busby Dr David Goldstone	Auckland Auckland Auckland Canterbury Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2019-2	Micro Crystallography (MX2) "Auckland Structural Biology CAP"	Merit Access 3 shifts 10-11 August	
Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Prof Vic Arcus Dr Andrew Sutherland-Smith Vince Carbone Joanna Hicks Carlin Hamill	VUW Massey AgResearch Waikato Massey AgResearch Waikato Waikato	2019-2	Macromolecular Crystallography (MX1) "Protein Structure and Function: Waikato, Victoria and Massey Universities and AgResearch NZ"	Merit Access 3 shifts 6-7 July **Rescheduled to 18-19 Aug because of instrument issues**	
Assoc Prof Chris Squire Dr Nikki Moreland Dr Shaun Lott Dr Jodie Johnston Assoc Prof Alok Mitra Dr Richard Kingston Prof Juliet Gerrard Dr Ivanhoe Leung Dr Ghader Bashiri Dr Jason Busby Dr David Goldstone	Auckland Auckland Auckland Canterbury Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2019-2	Macromolecular Crystallography (MX1) "Auckland Structural Biology CAP" **First period of beamtime not used as there were no samples ready. The second period was cancelled because of MX1 machine issues.**	Merit Access 6 shifts 4-5 July 24-25 July	
Dr Ben Mallett Prof Christian Bernard Andrew Chan Rakesh Arul Joseph Vella Sneh Patel	Auckland Fribourg Uni Auckland Auckland Auckland Auckland	2019-2	Soft X-ray Spectroscopy (SXR) "Interfacial Orbital Order in Cuprate-Manganite Multilayer Thin Film Sandwiches"	Merit Access 15 shifts 30 Jul-4 Aug	
Dr Peter Mace Prof Kurt Krause Dr Yoshio Nakatani Dr Joel Tyndall Assoc Prof Sigurd Wilbanks Prof Catherine Day	Otago Otago Otago Otago Otago Otago	2019-2	Micro Crystallography (MX2) "University of Otago Structural Biology Group"	Merit Access 3 shifts 31 Jul-1 Aug	

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Prof Vic Arcus Dr Andrew Sutherland-Smith	VUW Massey AgResearch Waikato Massey	2019-2	Micro Crystallography (MX2) "Protein Structure and Function: Waikato, Victoria and Massey Universities and AgResearch NZ"	Merit Access 3 shifts 3-4 Aug	
Prof Geoff Jameson Prof Vic Arcus Dr Yifei Fan Prof Emily Parker Gerd Mittelstaedt Ruby Roach	Massey Waikato VUW VUW VUW Massey	2019-1	Small/Wide Angle X-ray Scattering (SAXS) "Protein Complex Formation and Conformational Change"	Merit Access 3 shifts 15-16 August **Rescheduled time from March because of instrument issues in 2019/1 period**	
Dr Konstantin Pavlov Dr Andrew Stevenson Dr Sheridan Mayo Dr Anton Maksimenko Assoc Prof Timur Gureyev Dr Joshua Bowden Prof David Paganin Dr Ben Kennedy Dr Thomas Li Marcus Kitchen Sheridan Mayo	Canterbury Austr Synch CSIRO Austr Synch Melbourne U CSIRO Monash U Canterbury Canterbury Monash U CSIRO	2019-3	Imaging and Medical (IM) "Speckle-based phase-contrast imaging and tomography of weakly attenuating objects"	Merit Access 6 shifts 13-15 Sep	
Assoc Prof Chris Squire Dr Ghader Bashiri Dr Ivanhoe Leung Dr Nikki Moreland Dr Shaun Lott Dr David Goldstone Shayhan Chunkath Jamie Taka	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2019-3	Micro Crystallography (MX2) "Auckland Structural Biology CAP"	Merit Access 6 shifts 21-22 Sep 7-8 Nov	
Assoc Prof Mark Waterland Sam Brooke Robert McEwen Assoc Prof Geoff Waterhouse Dr Anna Garden Charlie Ruffman	Massey Massey Massey Auckland Otago Otago	2019-3	THz/Far Infrared (THz) "Characterising vibrational modes of at the edges of low-dimensional nanomaterials: Terahertz spectroscopy of MoS_2 nanoribbons and quantum dots"	Merit Access 9 shifts 24-27 Sep	
Prof James White Dr Tobias Durig Hazel Conway Dr Alex Nichols Dr Kazuhiko Kano Dr Rebecca Carey	Otago Otago Otago Canterbury Japan U. Tasmania	2019-3	Infrared Microscope (IRM) "Magmatic volatile evolution during the Shinjima eruption, Kyushu, Japan; insight into submarine eruption processes and comparison with products of the 2012 eruption of Havre volcano, Kermadec Arc, southwest Pacific."	Merit Access 9 shifts 25-28 Sep	

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Dr Adam Middleton Prof Kurt Krause Dr Yoshio Nakatani Prof Catherine Day Assoc Prof Sigurd Wilbanks Dr Peter Mace Assoc Prof Brian Monk Cameron Reddington Matthias Fellner	Otago Otago Otago Otago Otago Otago Otago Otago Otago	2019-3	Micro Crystallography (MX2) "University of Otago Structural Biology Group"	Merit Access 3 shifts 3-4 October	
Dr John Clements Assoc Prof Geoff Waterhouse Dr Wan-Ting Chen Prof Shane Telfer Nisansala Bandara Nicholas Symon	Massey Auckland Auckland Massey Massey Massey	2019-3	X-ray Absorption Spectroscopy (XAS) "From Nanoparticles to Single-Metal Atoms: XAS Characterisation of Atomically Disperse Materials for Heterogeneous Catalysis"	Merit Access 9 shifts 3-6 October	
Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Prof Vic Arcus Dr Andrew Sutherland-Smith Dr Gerd Mittelstaedt Dr Emma Summers Annmaree Warender Dr Yu Bai	VUW Massey AgResearch Waikato Massey VUW Waikato Waikato VUW	2019-3	Micro Crystallography (MX2) "Protein Structure and Function: AgResearch NZ and Waikato, Victoria and Massey Universities"	Merit Access 3 shifts 3-4 Oct	
Prof Thegn Ladefoged Dr Michel Nieuwoudt Dr Alex Jorgensen Dr Chris Stevenson	Auckland Auckland Auckland Virginia Common-wealth U	2019-3	Infrared Microscope (IRM) "Obsidian hydration dating of Māori artefacts using synchrotron FTIR measurements of speciation and concentration variation in molecular H_2O"	Merit Access 12 shifts 9-13 October	
Prof Margaret Brimble Dr Duncan McGillivray Prof David Williams Aakanksha Rani Dr Iman Kavianinia Shinji Kihara Sunandita Ghosh Zainab Makinde Dr Natalie Plank Dr Paul Hume Assoc Prof Justin Hodgkiss	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland VUW VUW VUW	2019-3	Small/Wide Angle X-ray Scattering (SAXS) "Peptide directed self-assembly in organic semiconducting molecule"	Merit Access 3 shifts 13-14 Nov	

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Dr Adam Middleton Prof Kurt Krause Dr Yoshio Nakatani Prof Catherine Day Assoc Prof Sigurd Wilbanks Dr Peter Mace Assoc Prof Brian Monk	Otago Otago Otago Otago Otago Otago Otago	2019-3	Macromolecular Crystallography (MX1) "University of Otago Structural Biology Group"	Merit Access 3 shifts 21-22 Nov	
Prof Geoff Jameson Prof Vic Arcus Prof Emily Parker Dr Gerd Mittelstaedt Yu Bai Dr Joanna Hicks Dr Emma Summers Dr Yifei Fan Ruby Roach Tracy Hale Elena Harjes Stefan Harjes Assoc Prof Vyacheslav Filichev	Massey Waikato VUW VUW VUW Waikato Waikato VUW Massey Massey Massey Massey Massey	2019-3	Small/Wide Angle X-ray Scattering (SAXS) "Protein Complex and Conformational Change"	Merit Access 3 shifts 22-23 Nov	
Dr Grant Pearce Assoc Prof Ren Dobson Dr Timothy Ryan James Davies Dr Rachel North Michael Currie	Canterbury Canterbury Aust. Synch. Canterbury Canterbury Canterbury	2019-1	Small/Wide Angle X-ray Scattering (SAXS) "Ad hoc SAXS CAP: Biomolecular Interactions"	Merit Access 3 shifts 23-24 Nov **Rescheduled from March due to beamline maintenance**	
Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Prof Vic Arcus Dr Andrew Sutherland-Smith Vince Carbone	VUW Massey AgResearch Waikato Massey AgResearch	2019-3	Macromolecular Crystallography (MX1) "Protein Structure and Function: AgResearch NZ and Waikato, Victoria and Massey Universities"	Merit Access 3 shifts 23-24 Nov	
Assoc Prof Chris Squire Dr Ghader Bashiri Dr Ivanhoe Leung Dr Nikki Moreland Dr Shaun Lott Dr David Goldstone George Randall	Auckland Auckland Auckland Auckland Auckland Auckland Auckland	2019-3	Macromolecular Crystallography (MX1) "Auckland Structural Biology CAP"	Merit Access 3 shifts 29-30 Nov	
Dr Courtney Ennis	Otago	2019/3	THz/Far Infrared (THz) "The far-IR identification of new low temperature phases of acrylonitrile ice."	Merit Access 9 shifts 3-6 Dec	
Dr Courtney Ennis Dr Helen Maynard-Casely Dr Helen Brand Dr Rebecca Auchettl Nick Yevstigneyev	Otago ANSTO Aust. Synch. Aust. Synch. Otago	2020-1	Powder Diffraction (PD) "The crystal structure of solid propanal: an interstellar precursor for alanine formation"	Merit Access 3 shifts 18-19 February	

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Dr Hannah Wells Prof Richard Haverkamp Dr Katie Sizeland Prof Chris Cunningham Dr Celia Kueh Georgina Harris Dr Christina Kamma-Lørger	Massey Massey ANSTO Massey Massey Massey ANSTO	2020-1	Small/Wide Angle X-ray Scattering (SAXS) "Collagen structural changes in decellularised arteries"	Merit Access 3 shifts 20-21 February	
Dr Saifang Huang Xin Song Tingxuan Yang Guoxing Qu Yuguang Pu	Auckland Auckland Auckland Auckland Auckland	2020-1	Powder Diffiraction (PD) "Operando study on the oxygen release and thermal stability of oxygenated 114-type cobaltites by synchrotron powder diffraction"	Merit Access 9 shifts 21-24 February	
Assoc Prof Chris Squire Dr Shaun Lott Dr Ivanhoe Leung Dr Ghader Bashiri Dr David Goldstone George Randall	Auckland Auckland Auckland Auckland Auckland Auckland	2020-1	Micro Crystallography (MX2) "2019/3 CAP Program"	Merit Access 6 shifts 22-23 Feb **26-27 Apr COVID Affected** Rescheduled to 9-10 Jun	
Dr Adam Middleton Prof Kurt Krause Dr Yoshio Nakatani Prof Catherine Day Assoc Prof Sigurd Wilbanks Dr Peter Mace Assoc Prof Brian Monk Dr Matthias Fellner Assoc Prof Brian Monk Elham Tor Thornton Fokker	Otago Otago Otago Otago Otago Otago Otago Otago Otago Otago Otago	2020-1	Micro Crystallography (MX2) "University of Otago Structural Biology Group"	Merit Access 3 shifts 29 Feb-1 Mar	
Assoc Prof Martin Allen Liam Carroll Prof Roger Reeves Caixia Hou Jonty Scott	Canterbury Canterbury Canterbury Canterbury Canterbury	2020-1	Soft X-ray Spectroscopy (SXR) "Tuning the 2-D electron gas at the surfaces of perfectly-square SnO_2 nanotubes and nanospirals for electrocatalytic applications.	Merit Access 15 shifts 3-8 March	
Assoc Prof Geoff Waterhouse Dr Wan-Ting Chen Eleonre Wild Nisansala Bandara	Auckland Auckland Auckland Massey	2020-1	Soft X-ray Spectroscopy (SXR) "Local electronic structure of nitrogen-doped carbon catalysts for renewable energy applications"	Merit Access 15 shifts 10-15 March	

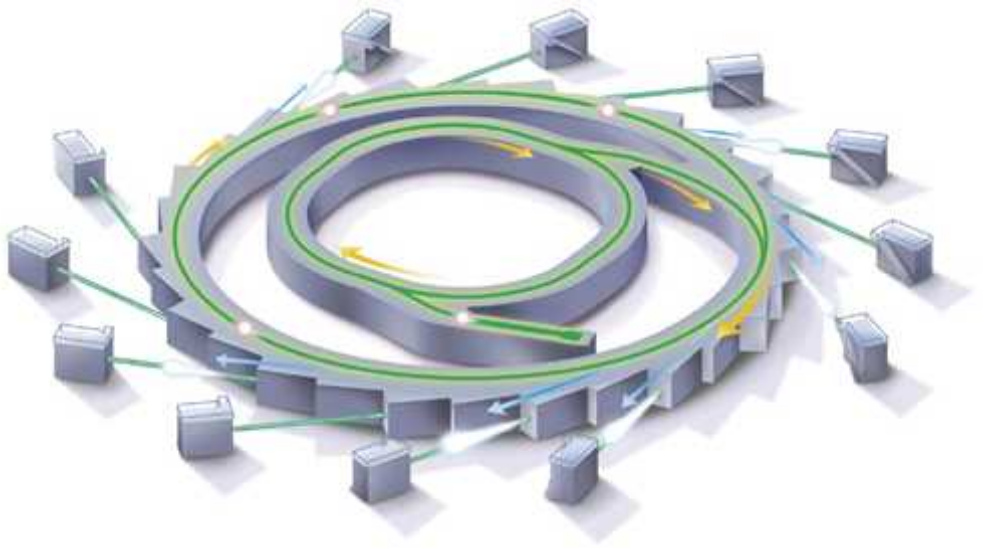
Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Prof Vic Arcus Dr Andrew Sutherland-Smith Assoc Prof Wayne Patrick	VUW Massey AgResearch Waikato Massey VUW	2020-1	Macromolecular Crystallography (MX1) "Protein Structure and Function: AgResearch NZ and Waikato, Victoria and Massey Universities"	Merit Access 3 shifts 12-13 March	
Dr Manisah Sharma Ben Boyd Darren Svirskis Hani Abdeltawab	Auckland Monash Auckland Auckland	2020-1	Small/Wide Angle X-ray Scattering (SAXS) "Phase transitions and kinetics of thermo-responsive in-situ gels"	Merit Access 3 shifts 14-15 March	
Dr Adam Middleton Prof Kurt Krause Dr Yoshio Nakatani Prof Catherine Day Assoc Prof Sigurd Wilbanks Dr Peter Mace Assoc Prof Brian Monk	Otago Otago Otago Otago Otago Otago Otago	2020-1	Macromolecular Crystallography (MX1) "University of Otago Structural Biology Group"	Merit Access 3 shifts 20-21 March	
Assoc Prof Chris Squire Dr Shaun Lott Dr Ivanhoe Leung Dr Ghader Bashiri Dr David Goldstone	Auckland Auckland Auckland Auckland Auckland	2020-1	Macromolecular Crystallography (MX1) "2019/3 CAP Program"	Merit Access 3 shifts 25-26 March **COVID Affected** Rescheduled to July	
Dr Lauren Macreadie Prof Bronwyn Fox Dr Helen Brand	Massey Swinburne Aust Sych	2020-1	Powder Diffraction (PD) "High Pressure Endurance and Flexibility of Multicomponent Metal Organic Frameworks"	Merit Access 6 shifts 7-9 April **COVID Affected** Postponed until 2021	
Dr Wan-Ting Chen Assoc Prof Geoff Waterhouse Qing Wang	Auckland Auckland Auckland	2020-1	X-ray Absorption Spectroscopy (XAS) "XAS characterization of porphyrin-like single Fe and Mn atom sites in MOF-derived N-doped porous carbons: Towards oxygen reduction reaction (ORR)"	Merit Access 6 shifts 7-9 April **COVID Affected** Rescheduled to October	
Assoc Prof Ren Dobson Chris Horne Amanda Board Dr Grant Pearce Michael Currie Dr Vanessa Morris	Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury	2020-1	Small/Wide Angle X-ray Scattering (SAXS) "University of Canterbury SAXS Proposal 2020/1"	Merit Access 2 shifts 28-29 April **COVID Affected** Rescheduled to July	

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Prof Geoff Jameson Prof Vic Arcus Dr Gerd Mittelstaedt Dr Yu Bai Prof Emily Parker Dr Joanna Hicks Dr Emma Summers Dr Yifei Fan Ruby Roach Dr Tracey Hale Dr Elena Harjes Dr Stefan Harjes Assoc Prof Vyacheslav Filichev	Massey Waikato VUW VUW VUW Waikato Waikato VUW Massey Massey Massey Massey Massey	2020-1	Small/Wide Angle X-ray Scattering (SAXS) "Protein Complex and Conformational Change"	Merit Access 3 shifts 29-30 April **COVID Affected** Rescheduled to October	
Prof Emily Parker Prof Geoff Jameson Dr Ron Ronimus Prof Vic Arcus Dr Andrew Sutherland-Smith Assoc Prof Wayne Patrick	VUW Massey AgResearch Waikato Massey VUW	2020-1	Micro Crystallography (MX2) "Protein Structure and Function: AgResearch NZ and Waikato, Victoria and Massey Universities"	Merit Access 3 shifts 1-2 May **COVID Affected** Postponed to 2021	$2,321
Beamtime from the 2020/2 cycle that would normally have been scheduled in May and June has been rescheduled for the October to December period where samples can be shipped to Australia and the experiments run remotely. All other beamtime awarded has been deferred until 2021 in anticipation of international travel resuming.					
New Zealand Researchers with Projects in Australian Based Collaboration Access Programs					
Prof Paul Kruger Lily Hermansplan Dr Colm Healy Carline Klenjan Dr Daniel Preston Ben Howard Komal Patil Chris Fitchett Nathan Harvey-Read	Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury	2019-3 to 2020-2	Macromolecular Crystallography (MX1) "Spin-Crossover Materials and Metal Organic Frameworks"	Merit Access 1 shift Various dates	
Prof Paul Kruger Lily Hermansplan Dr Colm Healy Carline Klenjan Dr Daniel Preston Ben Howard Komal Patil Chris Fitchett Nathan Harvey-Read	Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury	2019-3 to 2020-2	Micro Crystallography (MX2) "Spin-Crossover Materials and Metal Organic Frameworks"	Merit Access 3 shifts Various dates	
Professor Shane Telfer Dr Lauren Macreadie David Perl	Massey Massey Massey	2019-3 to 2020-2	Macromolecular Crystallography (MX1) "Structural Elucidation of Metal-Organic Frameworks"	Merit Access 2 shifts Various dates	
Professor Shane Telfer Dr Lauren Macreadie David Perl	Massey Massey Massey	2019-3 to 2020-2	Micro Crystallography (MX2) "Structural Elucidation of Metal-Organic Frameworks"	Merit Access 4 shifts Various dates	

Researchers	Institution	Cycle	Beamline	Access	Travel Funding
Dr Tim Allison	Canterbury	2019-3 to 2020-2	Macromolecular Crystallography (MX1) "Exposing the intricate interactions of membrane-bound bacterial machinery"	Merit Access 2 shifts Various dates	
Dr Tim Allison	Canterbury	2019-3 to 2020-2	Micro Crystallography (MX2) "Exposing the intricate interactions of membrane-bound bacterial machinery"	Merit Access 4 shifts Various dates	
Dr Jodie Johnson Dr Tasmyn Stanborough Dr Ngoc Anh Thu Ho Connor O'Rouke	Canterbury Canterbury Auckland Canterbury	2019-3 to 2020-2	Macromolecular Crystallography (MX1) "Understanding, Engineering and Inhibiting Enzymes Involved in Menaquinone Biosynthesis in Human Pathogens and Chemoreception in Plant Pathogens"	Merit Access 2 shifts Various dates	
Dr Jodie Johnson Dr Tasmyn Stanborough Dr Ngoc Anh Thu Ho Connor O'Rouke	Canterbury Canterbury Auckland Canterbury	2019-3 to 2020-2	Micro Crystallography (MX2) "Understanding, Engineering and Inhibiting Enzymes Involved in Menaquinone Biosynthesis in Human Pathogens and Chemoreception in Plant Pathogens"	Merit Access 6 shifts Various dates	
Assoc Prof Ren Dobson Dr Rachel North James Davies Michael Currie Jenna Gilkes Christopher Horne Amanda Board	Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury	2019-3 to 2020-2	Macromolecular Crystallography (MX1) "Protein-DNA interactions; Integral membrane proteins; Enzymes for drug discovery (fragemeng screening); Alternative Food proteins"	Merit Access 3 shifts Various dates	
Assoc Prof Ren Dobson Dr Rachel North James Davies Michael Currie Jenna Gilkes Christopher Horne Amanda Board	Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury Canterbury	2019-3 to 2020-2	Micro Crystallography (MX2) "Protein-DNA interactions; Integral membrane proteins; Enzymes for drug discovery (fragemeng screening); Alternative Food proteins"	Merit Access 9 shifts Various dates	

Australian Synchrotron

A synchrotron is a large research facility that generates an extremely intense beam of electromagnetic radiation (‘light’) that can be used for scientific experiments. The radiation is produced by taking a stream of electrons travelling at close to the speed of light, and deflecting them with magnetic fields. The light covers the electromagnetic spectrum from the infrared to the hard x-ray region.



Electrons are generated in the linear accelerator (linac), and progress into the smaller ‘booster’ ring, where they are further accelerated up to their final velocity (99.99% of the speed of light, a kinetic energy of 3.0 GeV). At this point they are ‘injected’ into the larger storage ring, where they circulate for a period of hours to days. The electron beam is steered and focused by magnetic fields. At each point where the beam is deflected, electromagnetic radiation is produced tangential to the beam path. ‘Insertion devices’, undulators and wigglers, are periodic magnet structures that serve to increase the radiation flux by up to five orders of magnitude. The radiation produced can be used in many different experiments and techniques. The light is channelled from the ring down a number of ‘beam lines’, each of which is optimised for a particular experimental technique.

The facility currently has ten beamlines that have been operating for some time with a further eight approved for design and construction over the next six years. The existing beamlines are:

- Protein crystallography (MX1) was the first beam line to become operational and began accepting general users in January 2008. This technique uses x-ray diffraction to determine the structure of proteins, used in drug design and understanding biochemical interactions.
- Infrared spectroscopy and microscopy (IR) also came online in early 2008. The beam line features two endstations: an FTIR spectrometer (THz) and an infrared microscope (IRM).
- Powder diffraction (PD) began taking general users in February 2008 and was fully operational by May 2008. This beam line is a general purpose diffraction beam line with several sample environments for observing changes in materials structure as a function of temperature, pressure, time, etc.

- The Soft X-ray Absorption Spectroscopy (SXR) beamline was available for general users from the September-December 2008 cycle. It operates at low x-ray energies and is most useful for surface studies.
- Final commissioning of the X-ray absorption spectroscopy (XAS) beam line was completed at the end of 2008 and became available to general users from January 2009. This technique is useful for probing elemental valence states and determining the local structure around an atomic species of interest.
- Small-angle x-ray scattering (SAXS), combined with wide-angle x-ray scattering (WAXS) is a useful technique for determining large scale (1-100 nm), short-range order in materials. This beamline came online at the beginning of 2009.
- The commissioning of the second protein crystallography and small-molecule crystallography beamline (MX2) was completed in mid 2009. It complements the existing protein crystallography beam line and is able to measure micron-sized crystals and other weakly-scattering or hard to crystallise systems.
- The microspectroscopy beamline (XFM) construction was also completed in early 2009. This beamline combines the high spatial resolution of a microscope with the information that can be gleaned through x-ray fluorescence spectroscopy.
- The Imaging and Medical beamline (IMBL) came into full use in 2013. It was redesigned from its original concept to include a 150 m long enclosure which extends well outside the Synchrotron building. It has the world's widest x-ray beam and can provide dynamic 3D x-ray imaging at very high resolution. In addition to its medical applications it is being used by geoscientists for tomography studies.

The New Zealand Synchrotron Group was one of ten foundation investors, each of whom has contributed A$5 million towards the initial suite of beam lines. This investment secured preferred (as-of-right) access for each foundation investor, spread over all the beam lines in addition to unrestricted access to the merit beamtime pool. The preferred access arrangements for foundation investors ceased in August 2013.

Following a transfer of ownership from the Victorian government and the other original foundation investors to ANSTO in 2016 and the securing of guaranteed operating funding for the next ten years, thoughts turned to the possibility of adding new beamlines to expand the facilities capabilities. Another campaign to raise funds was initiated which to date has raised in excess of A$93 million which will be used to add a further eight beamlines to the facility. Design work on the first three beamlines commenced in July 2017, three more in July 2018 and the final two in July 2019. New Zealand has contributed A$12 million towards the new beamlines with a 50:50 contribution from the New Zealand research sector and the government.

As part of the re-financing of New Zealand's funding of the new beamlines and the ongoing operations of the Synchrotron, it was possible to secure an increase in the amount of merit beamtime set aside for New Zealand researchers from 201 shifts to 267 shifts per year, as well as receiving proportionate rights to the merit and preferred access shifts that will become available as each new beamline is commissioned. The agreement does not expire until June 2026. The agreement also guaranteed that the new BioSAXS beamline, which has capability of particular interest to New Zealand researchers, would be one of the first beamlines to be added to the facility.

Prior to COVID, all the new beamlines were on track to be completed on time, however, the closure of the Australian Synchrotron in early 2020 and sites in Europe where the hutches that will contain the instrumentation for the MEX and MCT beamlines and restrictions placed on engineers from the manufacturer coming to Australia to install them has meant that the first three beamlines are likely to be up to 9 months late in being completed. The remaining beamlines have not affected.

Details of the new beamlines are:

Medium Energy XAS (MEX1 and MEX2) Year 1 (design commenced July 2017)
The MEX beamline will have two independently operated end-stations and provide medium energy absorption spectroscopy optimised for cutting-edge applications in biological, agricultural and environmental science. They will cover an energy range not currently available to Australian and New Zealand researchers, allowing X-ray absorption spectroscopy measurements of a group of very important elements such as sulphur, phosphorus, silicon and chlorine. Focusing optics will include a microprobe

Applications include environmental studies of inorganic, organophosphate and organochlorine pollutants, water pollution, plant growth, micro-nutrient transport and soil salinity, as well as studies of biomineralisation.

Micro-Computed Tomography (MCT) Year 1 (design commenced July 2017)
Micro-computed tomography opens a window on the micron-scale 3D structure of a wide range of samples relevant to many areas of science including life sciences, materials engineering, anthropology, palaeontology and geology. The MCT beamline will enable high-throughput and dynamic micro-CT down to submicron resolution. A key feature will be speed of data collection, focusing both on applications where many samples are imaged and experiments where a single specimen is imaged many times to observe dynamic responses to temperature, pressure, strain or other changing environmental conditions.

BioSAXS Year 2 (design commenced July 2018)
The BIOSAXS beamline will be specifically designed for structural biology and will have equal or better specifications than the current SAXS beamline, combined with specialised facilities for protein work, giving scientists and industry unprecedented access to the most sophisticated tools available.

Applications include a great impact in the study of the structure of larger biomedical molecules involved in the critical functions of human cells, such as proteins and the nucleic acids that comprise the genetic material within cells, and the study of interactions between biological molecules and new drugs.

Advanced Diffraction and Scattering (ADS1 and AD2) Year 2 (design commenced July 2018)
The ADS beamline will also have two independent end-stations providing capabilities previously unavailable in Australasia with two high energy beamlines for polychromatic and monochromatic x-ray diffraction and imaging. Applications include: studies of mineral formation and recovery under extreme conditions of temperature and pressure; non-destructive detection of cracking, fractures, textures, strains and deformations in large manufactured objects across the energy, automotive, transport, defence and aerospace sectors; maintenance and component failure studies of engineering infrastructure; and studies of corrosion and cracking in aluminium alloys used in aircraft and marine platforms

High Performance Macromolecular Crystallography (MX3) Year 3 (design commenced July 2019)
This ultra-high flux micro-focus macromolecular crystallography beamline is intended for small and/or poorly diffracting samples. The most important targets for the design of novel drugs include difficult large assemblies, which rarely produce crystals of sufficient size for analysis using traditional macro or micro-molecular crystallography beamlines. The HMX beamline will enable the study of sub-5µm crystals, providing a state-of-the-art high-throughput facility for researchers to study very small, weakly diffracting crystals of protein fragments and solution studies of protein fragments.

Applications include: in membrane proteins and receptors; virology; and materials science. The beamline will take advantage of the latest developments in high-throughput crystallography, including robot handling of 96-well crystallisation plates.

X-ray Fluorescence Nanoprobe (design commenced July 2019)
The multimodal nanoprobe beamline will be optimised for fluorescence detection, allowing the mapping of metals inside samples with extremely high resolution and sensitivity. It will have three operating modes: high resolution mapping (80nm), high-flux mapping (160nm resolution) and spectroscopy (160nm resolution).

Applications will come from researchers in physics, chemistry, biology, nutrition and health, geosciences, engineering, environmental research, soil science, agriculture, cultural heritage, and materials science.

CORPORATE GOVERNANCE

Board Composition

The company operates with a board comprising of 5 directors, including an independent chairman. Interim directors were appointed initially. These were replaced by a permanent board following elections which were held in April 2007.

The Directors during the period 1 July 2019 to 30 June 2020 were:

Dr Garth Carnaby, Chair
Professor Catherine Day, University of Otago
Professor Geoffrey Jameson, Massey University
Professor Michael McWilliams, formerly CSIRO
Professor James Metson, The University of Auckland

Indemnities and Insurance

The board has taken Directors and Officers Liability Insurance with Lumley General Insurance Limited. Coverage of up to $6 million has been obtained.

Attendance at Board Meetings

The following table shows the attendance at meetings of the board for each director and the fees paid.

Director	No. meetings held during the year	No. meetings attended	Fees paid
Dr Garth Carnaby	5	5	$9,000
Professor Catherine Day	5	5	
Professor Geoffrey Jameson	5	4	-
Professor Michael McWilliams	5	4	-
Professor James Metson	5	5	-

Donations

The company did not make any donations during the period from establishment up to 30 June 2020.

Interests Register

During the course of undertaking its normal business activities in supporting the development of synchrotron science, the company provides assistance towards the travel costs for research staff from its shareholders. The practice at meetings of the board is for directors from organisations who are receiving financial support to declare an interest and to refrain from voting on that particular matter.
The following significant entries relating to the directors were recorded in the Interests Register during the year.

Director	Organisation/Entity	Nature of Interest
Dr GA Carnaby		
Shares Held	GA Carnaby & Associates Ltd	Controlling majority
Beneficiary of Trusts	Carnaby Trust	Trustee and discretionary beneficiary
	National Provident Fund	Annuity/Defined benefit
Offices Held	Dodd-Walls Centre of Research Excellence	Chair
	BioResource Processing Alliance	Chair
	Wool Industry Research Ltd	Chair
Prof GB Jameson		
Shares Held	Tower Ltd	Minority shareholder
Beneficiary of Trusts	Estate of MEB Jameson	Discretionary beneficiary
Offices Held	Massey University	Employee
Other Interests	Te Manawa Museums Trust Board	Board member
	Science Centre Trust, Palmerston North	Trustee
Prof JB Metson		
Shares Held	Vector Energy	Minority shareholder
Offices Held	University of Auckland	Deputy Vice-Chancellor Research
	Brain Research New Zealand	Board Member
	Maurice Wilkins Centre for Molecular Biodiscovery	Board Member
	Medical Technologies Centre of Research Excellence	Board Member
	Te Pūnaha Matatini	Board Member
	Dodd Walls Centre	Board Member
	Ngā Pae o te Maramatanga	Board Member
	High Value Nutrition National Science Challenge	Board Member
	A Better Start National Science Challenge	Board Member
	Auckland UniServices Ltd	Director
	Research and Education Advanced Network New Zealand (REANNZ)	Director
	Rotary Science & Technology Forum Trust	Trustee
Professor CL Day		
Offices Held	University of Otgao	Employee
	RSNZ Academy Executive Council	Member
	Healthier Lives Leadership Team	Member
	Maurice Wilkins CoRE	Member - AI
Shares Held	Fairholm Farming Ltd	Minority shareholder

New Zealand Synchrotron Group Limited
Financial statements
for the year ended 30 June 2020

Contents

Directors

G A Carnaby (Chair)
C L Day
G B Jameson
M O McWilliams
J B Metson

Registered Office

11 Turnbull Street
Thorndon
Wellington

Nature of business

The purpose of the company is to provide research access in the Australian Synchrotron for researchers from New Zealand. The company also promotes synchrotron science, assists in the capability of New Zealand researchers in synchrotron science and manages the travel funding for New Zealand researchers using the Australian Synchrotron.

Company Registration number

1865516

Independent auditor

Grant Thornton New Zealand

The Board has pleasure in presenting the annual report of the New Zealand Synchrotron Group Limited ("NZSG") incorporating the financial statements and the auditors' report, for the year ended 30 June 2020.

The Company has taken advantage of the reporting concessions available to it under sections 211(3) of the Companies Act 1993.

The Board of NZSG has authorised these financial statements presented on pages 7 to 19 for issue on 23 October 2020.

For and on behalf of the Board

G A Carnaby
Chair

23 October 2020

J B Metson
Director

23 October 2020

Grant Thornton

INDEPENDENT AUDITOR'S REPORT

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TO THE SHAREHOLDERS OF NEW ZEALAND SYNCHROTRON GROUP LIMITED FOR THE YEAR ENDED 30 JUNE 2020

The Auditor-General is the auditor of New Zealand Synchrotron Group Limited (the Company). The Auditor-General has appointed me, Brent Kennerley, using the staff and resources of Grant Thornton New Zealand Audit Limited, to carry out the audit of the financial statements of the Company on his behalf.

Opinion

We have audited the financial statements of the Company on pages 7 to 19, that comprise the statement of financial position as at 30 June 2020, the statement of comprehensive revenue and expenses, statement of changes in net assets and statement of cash flows for the year ended on that date and the notes to the financial statements that include accounting policies and other explanatory information; and

In our opinion:

- the financial statements of the Company on pages 7 to 19:
  - present fairly, in all material respects:
    - its financial position as at 30 June 2020; and
    - its financial performance and cash flows for the year then ended; and
  - comply with generally accepted accounting practice in New Zealand in accordance with Public Benefit Entity International Public Sector Accounting Standards Reduced Disclosure Regime ('PBE IPSAS RDR'); and

Our audit was completed on 04 November 2020. This is the date at which our opinion is expressed.

The basis for our opinion is explained below. In addition, we outline the responsibilities of the Board of Directors and our responsibilities relating to the financial statements, we comment on other information, and we explain our independence.

Basis for our opinion

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the Professional and Ethical Standards and the International Standards on Auditing (New Zealand) issued by the New Zealand Auditing and Assurance Standards Board. Our responsibilities under those standards are further described in the Responsibilities of the auditor section of our report.

We have fulfilled our responsibilities in accordance with the Auditor-General's Auditing Standards.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Emphasis of Matter – COVID-19

Without modifying our opinion, we draw attention to Note 18 of the financial statements, which explains the impact of the COVID-19 pandemic on the Company.

Due to the inherent uncertainty of the duration and impact of the pandemic it is not practicable to determine the full impact that the virus will have on the Company going forward, however the Directors' assessment is that it is unlikely to be significant to its long-term operations.

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Responsibilities of the Board of Directors for the financial statements

The Board of Directors is responsible on behalf of the Company for preparing financial statements that are fairly presented and that comply with generally accepted accounting practice in New Zealand. The Board of Directors is responsible for such internal control as it determines is necessary to enable it to prepare financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board of Directors is responsible on behalf of the Company for assessing the Company's ability to continue as a going concern. The Board of Directors is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting, unless the Board of Directors intends to liquidate the Company or to cease operations or has no realistic alternative but to do so.

The Board of Directors' responsibilities arise from the Crown Entities Act 2004 and the Education Act 1989.

Responsibilities of the auditor for the audit of the financial statements

Our objectives are to obtain reasonable assurance about whether the financial statements, as a whole, are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance, but is not a guarantee that an audit carried out in accordance with the Auditor-General's Auditing Standards will always detect a material misstatement when it exists. Misstatements are differences or omissions of amounts or disclosures, and can arise from fraud or error. Misstatements are considered material if, individually or in the aggregate, they could reasonably be expected to influence the decisions of readers taken on the basis of these financial statements.

For the budget information reported in the financial statements, our procedures were limited to checking that the information agreed to the company's operational budget 2019-2020.

We did not evaluate the security and controls over the electronic publication of the financial statements.

As part of an audit in accordance with the Auditor-General's Auditing Standards, we exercise professional judgement and maintain professional scepticism throughout the audit. Also:

- We identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- We obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control.
- We evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Board of Directors.
- We evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- We conclude on the appropriateness of the use of the going concern basis of accounting by the Board of Directors and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Company's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Company to cease to continue as a going concern.

We communicate with the Board of Directors regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Our responsibilities arise from the Public Audit Act 2001.

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Other information

The Board of Directors are responsible for the other information. The other information comprises the information included on pages 3 to 4, but does not include the financial statements and our auditor's report thereon.

Our opinion on the financial statements does not cover the other information and we do not express any form of audit opinion or assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information. In doing so, we consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based on our work, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Independence

We are independent of the Company in accordance with the independence requirements of the Auditor-General's Auditing Standards, which incorporate the independence requirements of Professional and Ethical Standard 1 (Revised): *Code of Ethics for Assurance Practitioners* issued by the New Zealand Auditing and Assurance Standards Board.

Other than the audit, we have no relationship with or interests in the Company.

Brent Kennerley
Grant Thornton New Zealand Audit Limited
On behalf of the Auditor-General
Wellington, New Zealand

New Zealand Synchrotron Group Limited
Statement of comprehensive revenue and expenses
for the year ended 30 June 2020

	Note	*2020 (Unaudited) Budget*	2020 Actual	2019 Actual
		$	$	$
Revenue from non exchange transactions				
Revenue for Australian Operations	3	*3,057,709*	3,013,633	2,990,849
Revenue from exchange transactions				
Revenue for NZ Operations	4	*120,000*	120,000	123,600
Other revenue	4	*110,000*	87,206	212,256
Total Revenue		*3,287,709*	3,220,839	3,326,705
Expenses				
Australian Synchrotron Group costs		*1,635,638*	1,614,579	1,601,531
(Gain) / Loss on fair value of derivatives		*50,000*	43,112	122,927
Other operating expenses	6	*1,598,983*	1,457,641	1,591,424
Operating expenditure		*3,284,621*	3,115,331	3,315,882
Total surplus/(deficit) for the year		3,088	105,508	10,823
Other comprehensive income		-	-	-
Total comprehensive revenue and expense		***3,088***	**105,508**	**10,823**

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 19.

New Zealand Synchrotron Group Limited
Statement of changes in net assets
for the year ended 30 June 2020

	Notes	Share capital $	Accumulated losses $	Total equity $
Balance as at 30 June 2018		2,912,162	(2,425,565)	**486,597**
Net surplus		-	10,823	10,823
Other comprehensive income		-	-	-
Total comprehensive revenue and expenses		-	10,823	10,823
Balance as at 30 June 2019		**2,912,162**	**(2,414,742)**	**497,420**
Net surplus		-	105,508	**105,508**
Other comprehensive income		-	-	-
Total comprehensive revenue and expenses		-	105,508	**105,508**
Balance as at 30 June 2020		**2,912,162**	**(2,309,234)**	**602,928**

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 19.

New Zealand Synchrotron Group Limited
Statement of financial position
as at 30 June 2020

ASSETS	**Note**	**2020**	**2019**
		$	**$**
Current assets			
Cash and cash equivalents	7	993,871	489,699
Trade and other receivables from exchange transactions	8	16,764	79,927
Prepayments	8	3,583	1,850
Derivative financial instruments	9	26,142	-
Total current assets		**1,040,360**	**571,475**
TOTAL ASSETS		**1,040,360**	**571,475**
LIABILITIES			
Current liabilities			
Trade and other payables	11	349,276	55,153
Derivative financial instruments		88,156	18,902
Total current liabilities		**437,432**	**74,055**
TOTAL LIABILITIES		**437,432**	**74,055**
Net assets		**$ 602,928**	**$ 497,420**
EQUITY			
Share capital	15	2,912,162	2,912,162
Accumulated losses		(2,309,234)	(2,414,742)
TOTAL EQUITY		**$ 602,928**	**$ 497,420**

For and on behalf of the Board

G A Carnaby
Chair

23 October 2020

J B Metson
Director

23 October 2020

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 19.

	Notes	2020 $	2019 $
Cash flows from operating activities			
Receipts			
Receipts from non exchange transactions		3,013,633	2,990,849
Receipts from exchange transactions		254,765	332,896
Interest	4	15,604	19,178
Net cash flows from operating activities		**3,284,002**	**3,342,923**
Payments			
Australian Synchrotron Group Costs		(1,614,579)	(1,601,531)
Less: Cash applied to Derivative Asset		0	-
Other expenses		(1,165,251)	(1,572,907)
Total cash applied		**(2,779,830)**	**(3,174,438)**
Net cashflows from operating activities	17	**504,172**	**168,485**
Cash flows from financing activities			
Receipts			
Contributions from shareholders		-	-
Net cash flows from financing activities		-	-
Net (decrease)/increase in cash and cash equivalents		504,172	168,485
Cash and cash equivalents at 1 July	7	489,699	321,214
Cash and cash equivalents at 30 June	7	**993,871**	**489,699**

These financial statements should be read in conjunction with the accompanying notes on pages 11 - 19.

Note 1. General information

New Zealand Synchrotron Group Limited ("the Company" or "NZSG") was incorporated on 13 September 2006. The Company is a Public Sector Public Benefit Entity. The purpose of the Company is to provide research access to the Australian Synchrotron for researchers from New Zealand. In addition, the Company also promotes synchrotron science, assists the development of capability of New Zealand researchers in synchrotron science and manages the travel funding for New Zealand researchers using the Australian Synchrotron. It has twelve shareholders who are all either New Zealand universities, Crown Research Institutes or Crown Entities. The company is managed by a five person board elected by the shareholders, including an independent Chair. The Chair receives remuneration; the other directors do not. The Royal Society of New Zealand has been contracted to provide secretariat services to the Board.

The Company's revenue consists of fees paid by both shareholders and the Ministry of Business Innovation and Employment ("MBIE") to provide support services and funds provided by the Australian Synchrotron for travel funding grants. Its registered office is 11 Turnbull Street, Thorndon, Wellington.

The financial statements are prepared on a going concern basis. The Company has entered into agreements for future access to the Australian Synchrotron up until 30 June 2026.

The Board has authorised the financial statements on 23 October 2020

Note 2. Significant accounting policies

(a) Basis of preparation

The financial statements of the Company have been prepared in accordance with Generally Accepted Accounting Practice in New Zealand (NZ GAAP). They comply with Public Benefit Entity Standards Reduced Disclosure Regime (PBE Standards RDR) and authoritative notices that are applicable to entities that apply PBE Standards.
The Company is eligible and has elected to report in accordance with Tier 2 PBE Standards RDR on the basis that the Company has no public accountability and is not large as defined in XRB A1. The Directors have elected to report in accordance with Tier 2 PBE Accounting Standards and in doing so have taken advantage of all applicable Reduced Disclosure Regime ("RDR") disclosure concessions.
The significant accounting policies adopted in the preparation of the financial statements are set out below. These policies have been consistently applied to all the periods presented, unless otherwise stated.

Statutory base
New Zealand Synchrotron Group Limited ("NZSG" or the "Company") is a company registered under the Companies Act 1993.

The financial statements have been prepared in accordance with the Financial Reporting Act 2013.

Basis of measurement

These financial statements have been prepared under the historical cost convention, as modified by the revaluation of financial instruments at fair value through surplus or deficit.

(b) Changes in accounting policy

There have been no changes in accounting policy.

(c) Foreign currency translation

Functional and presentational currency
The financial statements are presented in New Zealand dollars, which is the Company's functional and presentation currency.

Foreign currency transactions are translated into the functional currency using the exchange rates prevailing at the dates of the transactions. Foreign exchange gains and losses resulting from the settlement of such transactions and from the translation at year end exchange rates of monetary assets and liabilities denominated in foreign currencies are recognised in the statement of comprehensive revenue and expenses.

(d) Revenue recognition

Revenue from exchange transactions

Revenue from exchange transactions comprises the fair value for the sale of goods and services, excluding Goods and Services Tax, rebates and discounts. Revenue is recognised when services are rendered.

Interest income

Interest income is recognised on a time proportion basis using the effective interest method. When a receivable is impaired, NZSG reduces the carrying amount to its recoverable amount, being the estimated future cash flow discounted at the original effective interest rate of the instrument, and continues unwinding the discount as interest income. Interest income on impaired loans is recognised using the rate of interest used to discount the future cash flows for the purpose of measuring the impairment loss.

Other funding

Other funding includes grants from shareholders, contributions from Australian Synchrotron and other kinds of funding that meet the definition of exchange transactions. Other funding is recognised as revenue when it becomes receivable in the accounting period in which the services or activities related to the funding are rendered or completed. This is by reference to completion of the specific transaction assessed on the basis of the actual service provided or the activity completed as a proportion of the total service to be provided or activity to be completed.

Revenue from non-exchange transactions

Revenue from non-exchange transactions comprises the fair value received from a third party without directly giving approximately equal value in exchange.

Government grants

Contract income from the Ministry of Business, Innovation and Employment is a primary source of income for the Company. Government grants and non-government grants are recognised as revenue when they become receivable unless there is an obligation to return the funds if conditions of the grant are not met. If there is such an obligation, the grants are initially recorded as grants received in advance and recognised as revenue when conditions of the grant are satisfied.

(e) Income Tax

From 1 July 2009 the NZSG has been granted a Tax Exemption under Section CW49 of the Income Tax Act 2007. As a consequence NZSG will have no ongoing liability for Income Tax.

(f) Goods and Services Tax (GST)

The statement of comprehensive revenue and expenses has been prepared so that all components are stated exclusive of GST. All items in the statement of financial position are stated net of GST, with the exception of receivables and payables, which include GST invoiced.

(g) Cash and cash equivalents

Cash and cash equivalents includes cash on hand, deposits held at call with financial institutions, and other short term highly liquid investments with original maturities of three months or less, that are readily convertible to known amounts of cash, and which are subject to an insignificant risk of changes in value.

(h) Trade receivables

Trade receivables are recognised initially at fair value and subsequently measured at amortised cost, less provision for doubtful debts.

The recoverability of trade receivables is reviewed on an ongoing basis. Debts which are known to be uncollectible are written off. A provision for doubtful receivables is established when there is objective evidence that NZSG will not be able to collect all amounts due according to the original terms of receivables. The amount of the provision is the difference between the asset's carrying amount and the present value of estimated future cash flows, discounted at the effective interest rate. The amount of the provision is recognised in the statement of comprehensive revenue and expenses.

(i) Derivative financial instruments

Derivatives are categorised as financial assets and liabilities held for trading. Derivatives are initially recognised at fair value on the date a derivative contract is entered into and are subsequently re-measured at their fair value. Financial assets at fair value through surplus or deficit are subject to review for impairment at each reporting date. Derivatives are then impaired when there is any objective evidence that the derivatives are impaired. Impairment losses are incurred if there is objective evidence of impairment as a result of one or more events that occurred after the initial recognition of the derivatives and that loss event has an impact on the estimated future cashflows of those derivatives that can be reliably estimated. Gains and losses arising from changes in the fair value of the derivative financial instruments are presented in the statement of comprehensive income and expenses within gain/(loss) on fair value of derivatives. The fair value of derivative financial instruments are determined by using valuation techniques. Valuation techniques used include the use of comparable recent arm's length transactions, reference to other instruments that are substantially the same, option pricing models and other valuation techniques commonly used by market participants making the maximum use of market inputs and relying as little as possible on entity-specific inputs.

(j) Investments and other financial assets

NZSG classifies its investments in the following categories: loans and receivables. The classification depends on the purpose for which the investments were acquired. Management determines the classification of its investments at the initial recognition and re-evaluates this designation at every reporting date.

Loans and receivables are non derivative financial assets with fixed or determinable payments that are not quoted in an active market. They arise when NZSG provides money, goods or services directly to a debtor with no intention of selling the receivable. They are included in current assets, except for those with maturities greater than 12 months after the balance sheet date which are classified as non-current assets. 'Trade and other receivables' and 'cash and cash equivalents' are classified as loans and receivables in the statement of financial position.

Loans and receivables are subsequently carried at amortised cost using the effective interest method.

(k) Trade and other payables

These amounts represent liabilities for goods and services provided to NZSG prior to the end of financial year which are unpaid. The amounts are unsecured and are usually paid within 30 days of recognition. Trade and other payables are recognised initially at fair value and subsequently measured at amortised cost using the effective interest method.

(l) Sponsorship and donations expense

Through the ordinary course of its activities the Company provides sponsorships and makes donations to advance its stated objectives. The Company recognises a liability for this expenditure when the recipient meets any eligibility criteria attached to a sponsorship or donation agreement.

(m) Statement of Cash Flows

The following are the definitions of the terms used in the Statement of Cash Flows:

i) Cash is considered to be cash on hand, cash in transit, bank accounts and deposits with a maturity of no more than 3 months from the date of acquisition;

ii) Investing activities are those relating to acquisition, holding and disposal of investment in ASHC and investments not falling within the definition of cash;

iii) Financing activities are those activities which result in changes in the size and composition of the capital structure of the Company. This includes equity, debt not falling within the definition of cash.

All other activities are classified as operating activities.

Note 3. Revenue for Australian operations

	2020 $	2019 $
Revenue from non-exchange transactions		
Ministry of Business Innovation and Employment	963,294	940,000
MBIE - contribution to Australia Synchrotron beamlines	-	-
Shareholders - contribution to Aust. Synchrotron beamlines	1,258,086	1,250,217
Shareholders	792,253	800,632
	3,013,633	2,990,849

The Company receives support from the Government and shareholders for Australian Synchrotron costs.

Note 4. Revenue for New Zealand operations

	2020 $	2019 $
Revenue from exchange transactions		
Grants from shareholders for operating costs of NZSG	120,000	123,600
Other Revenue		
Contribution from the Australian Synchrotron towards travel costs	71,602	107,900
Funding for paid access to the Synchrotron	-	85,178
Interest	15,604	19,178
	87,206	212,256
	207,206	335,856

Note 5. Australian Synchrotron Group costs

Under the agreement with Australian Nuclear Science and Technology Organisation (ANSTO), and as detailed in note 10(a), the Company is required to make an annual contribution to the ongoing operating costs of the Australian Synchrotron.

Note 6. Other operating costs

(a) Remuneration of auditor

During the year the following fees were paid or payable for services provided by the Auditor General appointed auditor - Grant Thornton NZ.	2020 $	2019 $
Statutory audit services	6,610	6,610

(b) Foreign exchange (gains) / losses

During the year the following exchange (gains) / losses were made on transactions between New Zealand and Australia.

	2020 $	2019 $
Foreign exchange (gains) / losses	0	27,120

(c) Support for Synchrotron Science

During the year the following fees were paid or payable for services provided.

	2020 $	2019 $
Travel costs reimbursed to shareholders	72,984	105,319
Payments for access to Australian Synchrotron	0	73,242
Contribution to Australian Synchrotron for new beamlines	1,249,610	1,250,391
User Meetings	6,365	14,742
Asia Oceania Forum for Synchrotron Radiation Research Membership	15,115	5,000
	1,344,075	1,448,694

(d) Secretariat and other operating costs

During the year the following fees were paid or payable for services provided.

	2020 $	2019 $
Secretariat services from the Royal Society and Board costs	103,003	105,048
Insurance	3,700	3,425
Other	253	527
	106,956	109,000
Total other operating costs	**1,457,641**	**1,591,424**

Note 7. Cash and cash equivalents

	2020 $	2019 $
Cash	732,644	260,237
Foreign currency - AUD	261,227	229,462
	993,871	489,699

All the bank balances are held with the Bank of New Zealand.

Note 8. Other current assets

(a) Trade and other receivables

	2020 $	2019 $
Trade receivables	16,764	80,523
Other receivables	-	-
Total trade and other receivables	16,764	80,523

(b) Prepayments

	2020 $	2019 $
Prepayments	3,583	1,850
Total Prepayments	3,583	1,850

Note 9. Derivative financial instruments

	2020	2019
	$	$
Western Union Forward cover	(62,014)	(18,902)
Derivative financial instruments	**(62,014)**	**(18,902)**

The following derivatives have been entered into with Western Union.

(a) Forward foreign exchange contracts

At 30 June 2019	Notional	Deal rate	Fair Value
Forward exchange contract (Maturity: February 2020)	$755,124	0.9270	(21,220)
Forward exchange contract (Maturity: February 2021)	$787,402	0.9525	$1,689

At 30 June 2020	Notional	Deal rate	Fair Value
Forward exchange contract (Maturity: February 2021)	$787,402	0.9525	$16,367
Forward exchange contract (Maturity: February 2022)	$833,333	0.9000	(29,576)
Forward exchange contract (Maturity: February 2023)	$833,333	0.9000	(29,156)
Forward exchange contract (Maturity: February 2024)	$833,333	0.9000	(29,424)

(b) Forward foreign exchange options

At 30 June 2019	Notional	Strike Price	Fair Value
Forward foreign exchange option (Maturity: February 2020)	$6,825,985	0.85	$629

At 30 June 2020	Notional	Strike Price	Fair Value
Forward foreign exchange option (Maturity: February 2022)	$735,294	1.02	$2,687
Forward foreign exchange option (Maturity: February 2023)	$735,294	1.02	$3,099
Forward foreign exchange option (Maturity: February 2024)	$735,294	1.02	$3,989

Note 10. Commitments

(a) Agreement with Australian Nuclear Science and Technology Organisation (ANSTO)

Agreements have been signed on the 14th August 2017, between NZSG and ANSTO whereby NZSG undertakes to provide AUD $12.0m over six years towards the cost of new beamlines and AUD $1.5m per year for nine years (with an inflation adjustment) in return for 6.639% of the access. As part of the Funders' Agreement entered into with 10 of the shareholders and the SIFF Contract with MBIE, these funds will be received directly from the Participants or MBIE when required to fulfil these obligations.

New Zealand shareholders who are party to the Funders' Agreement are irrevocably committed to contribute a total of AUD $12.308m (GST exclusive).

(b) Agreement with Ministry of Business, Innovation and Employment (MBIE)

The company has entered into an agreement with MBIE for Crown Funding totalling AUD $6m plus NZD $10,552,364 over the period 1 July 2017 to 30 June 2026.

Note 11. Trade and other payables

	2020	2019
	$	$
Creditors	-	25,875
Accruals	8,074	29,278
Income in Advance	300,000	-
Goods and Services Tax payable	41,202	596
Total trade and other payables	349,276	55,749

The amount owed to related parties was nil as at 30 June 2020. (2019: nil).

Note 12. Contingent liabilities

There were no significant contingent liabilities at 30 June 2020. (2019: nil)

Note 13. Related parties

Related parties comprise the shareholders identified in Note 15 and Board members identified in the Directory. There have been a number of related party transactions during the year ended 30 June 2020.

Directors

Transactions with board members include payment of fees. During the year ended 30 June 2020, a total of $9,000 was paid to the Chair (2019: $9,000). As at 30 June 2020, there was no outstanding balances with board members (2019: $0).

Shareholders

Transactions with shareholders during the year ended 30 June 2020 include grants, as per Note 4, amounting to $120,000 (2019: $123,600). Also, as per Note 10, under the agreement with ANSTO the Shareholders who are party to the Funders Agreement are required to contribute a total of AUD $12.308m (GST exclusive) over the nine years of the agreement to 2026. In the year ended 30 June 2020, a total of AUD $1.9635m (2019: AUD $1.95m) was contributed by Shareholders who are party to the Funders Agreement and, as at 30 June 2020, there was no outstanding balance with shareholders (2019: $0).

Note 14. Events occurring after balance date

There were no significant events occuring after balance date that affect the financial statements. From an operational perspective, since balance date the Australian Nuclear Science and Technology Organisation (ANSTO) have proposed three options for the Company to consider for resumption of beamtime access to the Australian Synchrotron. Each of the options involves a reduced contribution payment for 2020-21 than would otherwise be required under the ANSTO agreement (as detailed in note 10(a), the Company is required to make an annual contribution to the ongoing operating costs of the Australian Synchrotron).

Note 15. Share capital

Shareholding at cost	2020 $	2019 $
The University of Auckland	509,217	509,217
The University of Waikato	190,357	190,357
Massey University	428,317	428,317
Victoria University of Wellington	237,966	237,966
University of Canterbury	285,546	285,546
Lincoln University	28,557	28,557
University of Otago Holdings Ltd	285,546	285,546
AgResearch Ltd	285,546	285,546
Institute of Geological and Nuclear Sciences Ltd	190,357	190,357
The New Zealand Institute for Plant and Food Research Ltd	190,357	190,357
Callaghan Innovation	192,270	192,270
Auckland University of Technology	88,126	88,126
	2,912,162	2,912,162

The shares held at 30 June are:	2020 # of shares held	2019 # of shares held
The University of Auckland	436,319	436,319
The University of Waikato	163,104	163,104
Massey University	367,001	367,001
Victoria University of Wellington	203,897	203,897
University of Canterbury	244,668	244,668
Lincoln University	24,467	24,467
University of Otago Holdings Ltd	244,668	244,668
AgResearch Ltd	244,668	244,668
Institute of Geological and Nuclear Sciences Ltd	163,104	163,104
The New Zealand Institute for Plant and Food Research Ltd	163,104	163,104
Callaghan Innovation	163,104	163,104
Auckland University of Technology	163,104	163,104
	2,581,208	2,581,208

The amount recognised in the balance sheet as paid in capital is the New Zealand dollar equivalent at the date of issue.

Note 16. Financial instruments

Classification of financial assets by category	Fair value through Profit or Loss	Loans and Receivables
2020	**$**	**$**
Cash and cash equivalents	-	993,871
Trade & other receivables	-	16,764
Prepayments	-	3,583
Derivative financial instrument	26,142	-
Total	**26,142**	**1,014,218**
2019		**$**
Cash and cash equivalents	-	489,699
Trade & other receivables	-	79,927
Prepayments	-	1,850
Derivative financial instrument	-	-
Total	**0**	**571,475**

Classification of financial liabilities by category

Measured at amortised cost

	2020	2019
	$	$
Trade & other payables	349,276	55,153
Derivative financial instrument	88,156	18,902
Total	**437,432**	**74,055**

Note 17. Reconciliation of profit with cash flows from operating activities

	2020	2019
	$	$
Net (Deficit)/Surplus for the year	105,508	10,823
Movement in working capital		
Trade and other receivables	63,163	16,218
Derivative financial instruments	43,112	122,927
Trade and other payables	294,122	13,792
Prepayments	(1,733)	4,725
Net Cash outflow from operating activities	**504,172**	**168,485**

Note 18. COVID-19 Pandemic and impacts

On 11 March 2020 the World Health Organisation declared a global pandemic in respect to the COVID-19 virus outbreak. Following establishment of a foothold within the New Zealand population, the New Zealand Government initiated a range of restrictions and measures in an attempt to eliminate the virus within New Zealand. As at the date of this report the impact of the pandemic is ongoing and is expected to have a significant long lasting economic impact on New Zealand, with likely flow through to most businesses. Due to the inherent uncertainty of the duration and impact of the pandemic it is not practicable to determine the full impact that the virus will have on the Company going forward, however the Directors' assessment is that it is unlikely to be significant to its long-term operations and therefore the Board continues to consider it appropriate to apply the going concern basis of accounting to these financial statements.

For the period up to 30 June 2020, the most obvious adverse impact on the operations of the Company was that the shutdown from mid-March of the Australian Synchrotron and the New Zealand and Australian border restrictions, both making physical access to the Australian Synchrotron for researchers from New Zealand impossible. Since 30 June 2020, physical access to the Australian Synchrotron for researchers from New Zealand continues to be an issue for an undetermined period. As per Note 14, and as at the date of this report, ANSTO have proposed three options for the Company to consider for resumption of beamtime access to the Australian Synchrotron. Each of the options involves a reduced contribution payment for 2020-21 than would otherwise be required under the ANSTO agreement (as detailed in note 10(a), the Company is required to make an annual contribution to the ongoing operating costs of the Australian Synchrotron). The Company has yet to make a decision on the most appropriate option, but will negotiate a payment reduction for 2020-21 to reflect the value of the deferred beamtime.